

PROBLEM SET 9. DUE MONDAY, 18 SEPTEMBER

Reading. *Quick Calculus*, pp. 199–207.

Supplementary reading. Simmons, Chapters 18, 19, 20.

1. There is a tent that has a circular base of radius 1 meter. The tent consists of stretching nylon fabric over a vertical semicircular pole (also of radius 1 meter) attached to the base at the opposite ends of a diameter. What is the volume of the tent? (Hint: The cross-sections are triangles.)
2. Rotate the circle $(x - 4)^2 + y^2 = 1$ around the y -axis. The solid that you get is a doughnut, also called a *torus*. Calculate the volume of this torus using the disc method. (Your discs will look like washers.)
3. There is a 3-dimensional solid with base in the xy -plane. The base is triangular, with vertices $(0, 0, 0)$, $(2, 2, 0)$ and $(2, -2, 0)$. The cross-sections of the solid when it is cut by planes perpendicular to the x -axis are squares. Compute the volume of this solid.
4. There is a 3-dimensional solid with base in the xy -plane. The base is triangular, with vertices $(0, 0, 0)$, $(2, 2, 0)$ and $(2, -2, 0)$. The cross-sections of the solid when it is cut by planes perpendicular to the x -axis are semi-circles. Compute the volume of this solid.
5. Compute the following multiple integrals.
 - (a) $\int_{y=0}^1 \int_{x=0}^1 x^2 y + xy^2 \, dx \, dy$
 - (b) $\int_{y=0}^1 \int_{x=0}^y 2\sqrt{y^2 + 1} \, dx \, dy$
 - (c) $\int_{x=0}^1 \int_{y=0}^{e^x} 4y \, dy \, dx$